



A.D. 1853 N° 2826.

SPECIFICATION

OF

JAMES ROBERTSON,

APPARATUS FOR CONSUMING SMOKE, AND
REGULATING SUPPLY OF FUEL TO
FURNACES.

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1854.



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**Apparatus for Consuming Smoke, and Regulating
Supply of Fuel to Furnaces.**

LETTERS PATENT to James Robertson, of Kentish Town, in the
County of Middlesex, Cooper, for the Invention of “**IMPROVEMENTS
IN THE CONSUMPTION OR PREVENTION OF SMOKE.**”

Sealed the 6th February 1854, and dated the 5th December 1853.

PROVISIONAL SPECIFICATION left by the said James Robertson
at the Office of the Commissioners of Patents, with his Petition,
on the 5th December 1853.

I, JAMES ROBERTSON, of Kentish Town, in the County of Middle-
5 sex, Cooper, do hereby declare the nature of the said Invention for
“**IMPROVEMENTS IN THE CONSUMPTION OR PREVENTION OF SMOKE**” to be
as follows :—

This Invention consists in placing either all round or partially
around the furnace or fire-containing chamber or grating, a series of
10 air-admitting apertures, so as to allow the air to act directly from
different sides upon the burning fuel. I also propose to use in con-
nection with this Invention a suitable apparatus, by which the entire
body or any part of the furnace may be let down, upon a new supply of

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fuel being introduced, so as to allow the level of the top of the fuel to be always in the same position with the grating or air-admitting apertures around; this being effected by weights, so that as the fuel is consumed, and consequently diminished in weight, it will itself rise up again to its position, and the attendant will thus be enabled 5 to see, by the state of the weights outside, the exact state or weight of the fuel in the furnace. By a similar arrangement, it is obvious that by lowering or raising one portion of the furnace, the whole of the fuel or ashes may be at once discharged from it. The bars of the furnace may also be arranged with apertures in them at any 10 convenient distances apart, into which jets may be inserted, each jet having an aperture below, so as to receive the air from underneath the fire, and terminating in a species of rose, or series of small holes or apertures, or in a single aperture, above the level of the burning fuel, by which means air will be let in throughout the whole 15 body of the furnace.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said James Robertson in the Great Seal Patent Office on the 5th June 1854.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, 20
JAMES ROBERTSON, of Kentish Town, in the County of Middlesex, Cooper, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fifth day of December, in the year of our Lord One thousand eight hundred and fifty-three, in the 25 seventeenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said James Robertson, Her special license that I, the said James Robertson, my executors, administrators, and assigns, or such others as I, the said James Robertson, my executors, administrators, or assigns, should at any time agree with, and no 30 others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and

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vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "**IMPROVEMENTS IN THE CONSUMPTION OR PREVENTION OF SMOKE,**" upon the condition (amongst others) that I, the said James Robertson, by an instrument in writing
5 under my hand and seal, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

10 **NOW KNOW YE**, that I, the said James Robertson, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the accompanying Drawings, and to the letters and figures marked thereon, that is
15 to say:—

My said Invention relates to an improved construction of furnace for effecting the consumption of smoke, and consists in placing either all round or partially around the furnace or fire containing chamber or grating, a series of air-admitting apertures, so as to allow the air
20 to act directly from different sides upon the burning fuel. I also propose to use in connection with this Invention a suitable apparatus, by which the entire body or any part of the furnace may be let down, upon a new supply of fuel being introduced, so as to allow the level of the top of the fuel to be always in the same position with the
25 grating or air-admitting apertures around; this being effected by weights or any other convenient arrangement, so that as the fuel is consumed, and consequently diminished in weight, it will itself rise up again to its position, and the attendant will thus be enabled to see, by the state of the weights outside, the exact state or weight of
30 the fuel in the furnace. By a similar arrangement, it is obvious that by lowering or raising one portion of the furnace, the whole of the fuel or ashes may be at once discharged from it. The bars of the furnace may also be arranged with apertures in them at any convenient distances apart, into which jets may be inserted, each jet
35 having an aperture below, so as to receive the air from underneath the

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fire, and terminating in a species of rose, or series of small holes or apertures, or in a single aperture, above the level of the burning fuel, by which means air will be let in throughout the whole body of the furnace, or a portion of it.

Figure 1 on Sheet 1 of the Drawings, represents a horizontal 5 section of a cylindrical steam boiler with internal flue, the greater portion of the fire bars being removed to shew the elevating levers. Figure 2 is a transverse vertical section of the boiler and furnace, taken through the dead plate. Figure 3 is a horizontal section of the boiler, shewing the furnace bars and burner in plan. Figure 4 10 is a longitudinal vertical section of the boiler and smoke-consuming apparatus, taken along the centre line thereof; and Figures 5, 6, 7, 8, and 9, are separate details of the smoke-consuming apparatus, which will be herein-after described.

Fig. 1 on Sheet 2 of the Drawings represents a horizontal section 15 of a steam boiler furnace with external flues, the grate bars being removed to shew the elevating mechanism. Figure 2 is a transverse section of the furnace taken through the front of the grate bars; and Figure 3 is a longitudinal vertical section of the same shewing the whole of the smoke-consuming apparatus. The same letters refer to the 20 corresponding parts in the different Figures of the Sheets of Drawings. The boiler A is of the ordinary cylindrical class, with internal cylindrical flue B. The greater number of the bars C are moveable, their inner ends resting upon the fixed transverse support D, whilst their front ends bear upon the moveable support E, which is connected by links F 25 to the pair of balance levers G, G. These levers work on the fixed transverse rod H, which serves as a centre, and are weighted at I, I, to balance the weight of the grate bars. The moveable portion of the grate is enclosed in a fixed cast iron frame J, shewn in detail at Figure 5. This frame projects downwards a short distance, and is per- 30 forated at the front end and sides by a number of perforations which act as air inlets to supply the air for combustion. By this means, the air entering from the ash pit is divided into a number of thin streams or currents, which impinge directly upon the upper surface of the burning fuel in the grate bars, and thereby assists in the combustion of the 35

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smoke and unconsumed gases evolved from the partially consumed fuel. By the employment of a moveable grate, as described, the size of the surrounding air inlets will be regulated according to the amount of fuel on the grate; thus, for example, when the fuel is first fed in, and the
5 grate full, the weight of the coal will depress it to its full extent, as shewn in Figs. 4 and 5; consequently a great amount of air will be admitted as the air inlets will be full open, but as the fuel burns away and becomes lighter, the weights on the ends of the levers G will elevate the grate bars, and reduce the supply of air by partially closing
10 the inlets before mentioned. The combustion of the smoke and unconsumed gases is also further assisted by the perforated burner K, which is situated near the inner end of the furnace. This burner, shewn in plan and end elevation at Figs. 7 and 8, may be composed of cast iron, fire clay, or of any other material suited to stand the fire, and is
15 so arranged as to be entirely surrounded with burning fuel. Fresh air is supplied to the interior of the burner by the pipe L, which opens into the under side of it. This pipe passes along the bottom of the ash pit, and is terminated by an expanded mouth at M, outside the front of the boiler; if necessary, a regulator or damper may be fitted into the
20 mouth M, to regulate the supply of air to the burner, according to the state of the fire in the furnace. An opening N is formed in the air pipe, which is fitted with a moveable lid, and serves to facilitate the removal of any dust or ashes which may be deposited in the angle of the pipe. To prevent the accumulation of dust or fine ash inside the
25 burner, two longitudinal slots O, O, (Fig. 7) are made in the bottom of the same, through which the dust is blown through into the fire again, where it is completely consumed, thereby preventing the injurious deposit of a large amount of dust and fine ash behind the bridge, which has hitherto been found to take place in smoke-consuming furnaces.
30 The air enters the furnace in a number of small streams or jets, having been previously heated by the fire surrounding the burner. By placing the burner in the fire and bringing the air into direct contact with the flame and smoke, the consumption is found to be more complete than when the air is mixed with the gases after they have passed away from
35 the fire. The cold air which enters the burner counteracts the heat

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outside, and prevents the burner from being burnt away. Figs. 9 and 6 represent two different forms of burners which may be employed in place of the one shewn in Fig. 4; the air being introduced at P, through the pipe L, as herein-before described. As the air is always in a heated state when issuing from the burner, it will have no tendency 5 to cool the flues, but on the contrary will assist in the generation of the steam. I may here observe, that I do not confine myself to any particular form or position of burner, or of the apertures therein, so long as it does not interfere with the draught of the furnace. One or more of these burners or modifications of the same may be placed on the 10 grate bars, which might be made hollow for that purpose, and receive a supply of heated air from the ashpit. Fig. 1 on Sheet 2 of my Drawings represents a horizontal section of a steam boiler furnace with the bars removed, to shew the elevating or balance weight and chains. Fig. 2 is a transverse section of the same taken through the front of 15 the fire bars; and Fig. 3 is a longitudinal vertical section of the furnace, shewing a portion of the boiler in elevation. This latter arrangement shows the application of my principle of smoke prevention to boiler furnaces with external or lateral flues. In this arrangement the furnace bars are balanced by counterweights A, suspended by the 20 chains B, which pass over the fixed guide pulleys C and D, and are attached at E to the rod E¹, which connects the two brackets F, F, secured to the moveable transverse bar G, on to which the front ends of the fire bars rest, as described with reference to the first arrangement, the opposite ends of the bars being supported by the fixed 25 transverse bar H. The air is admitted round the furnace through the perforated frame I, as herein-before described, and a burner J may be employed similar to that lettered K in Sheet 1 of the Drawings. The air, however, in this case is supplied from the ashpit itself, the mouth of the short supply pipe K being fitted with a self-acting valve or regu- 30 lator L, which is actuated by the descent or ascent of the grate bars. This is effected by connecting the valve L to a short chain M, which is attached to one or both of the elevating chains B, by a cross bar connecting the two chains, or by any other suitable arrangement. As the grate descends with the weight of the newly supplied fuel, the chains B 35

FIG. 1.

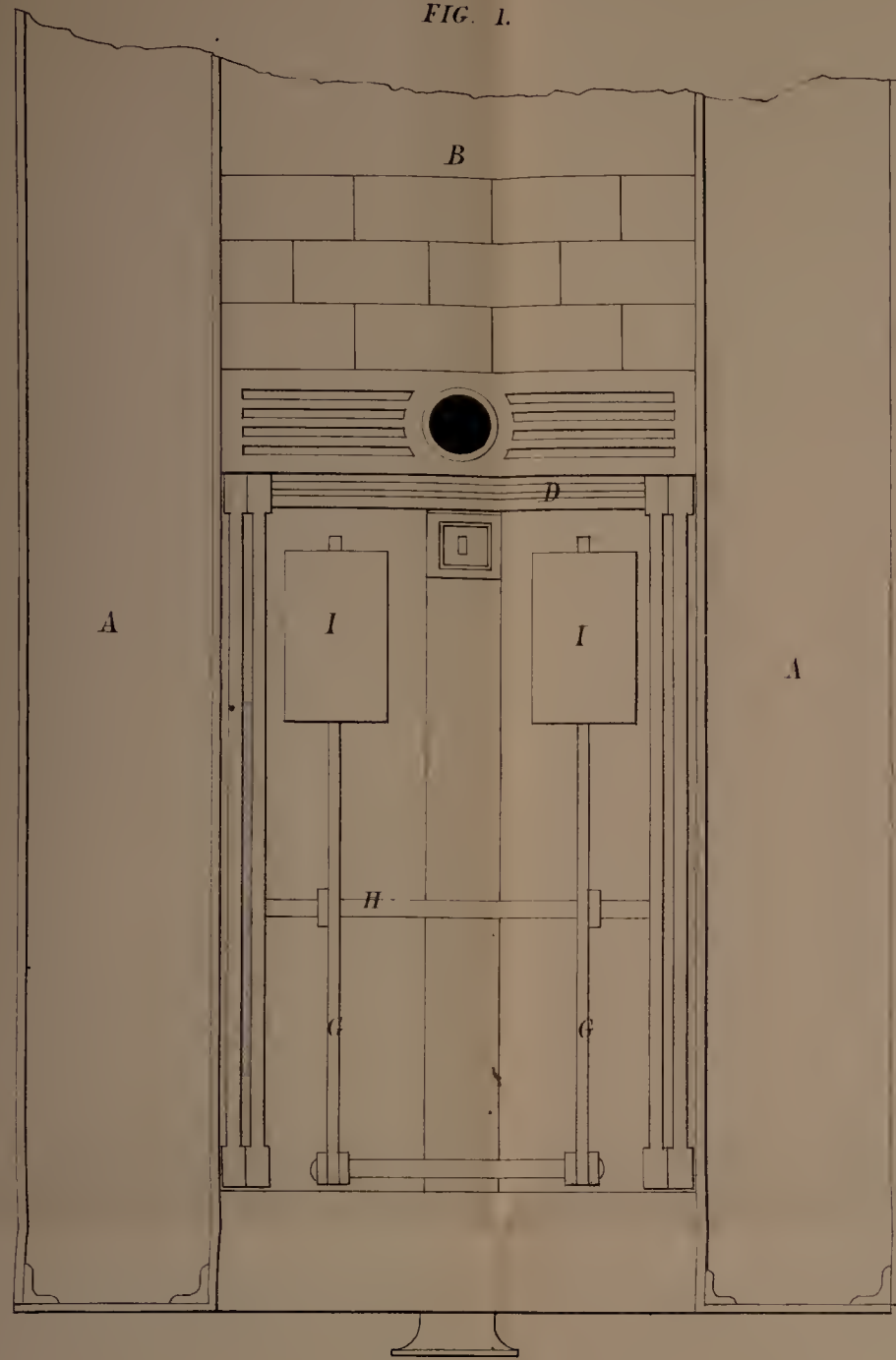


FIG. 5.

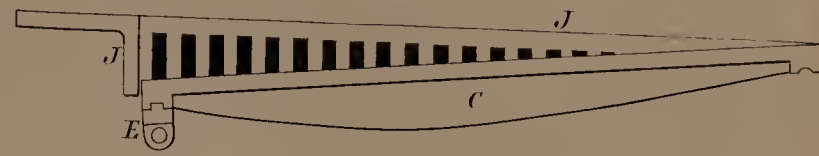


FIG. 6.



FIG. 9.

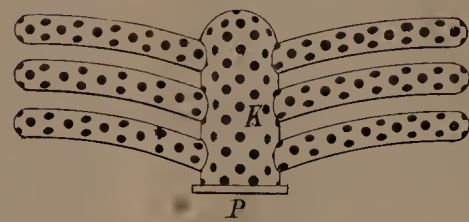


FIG. 3.

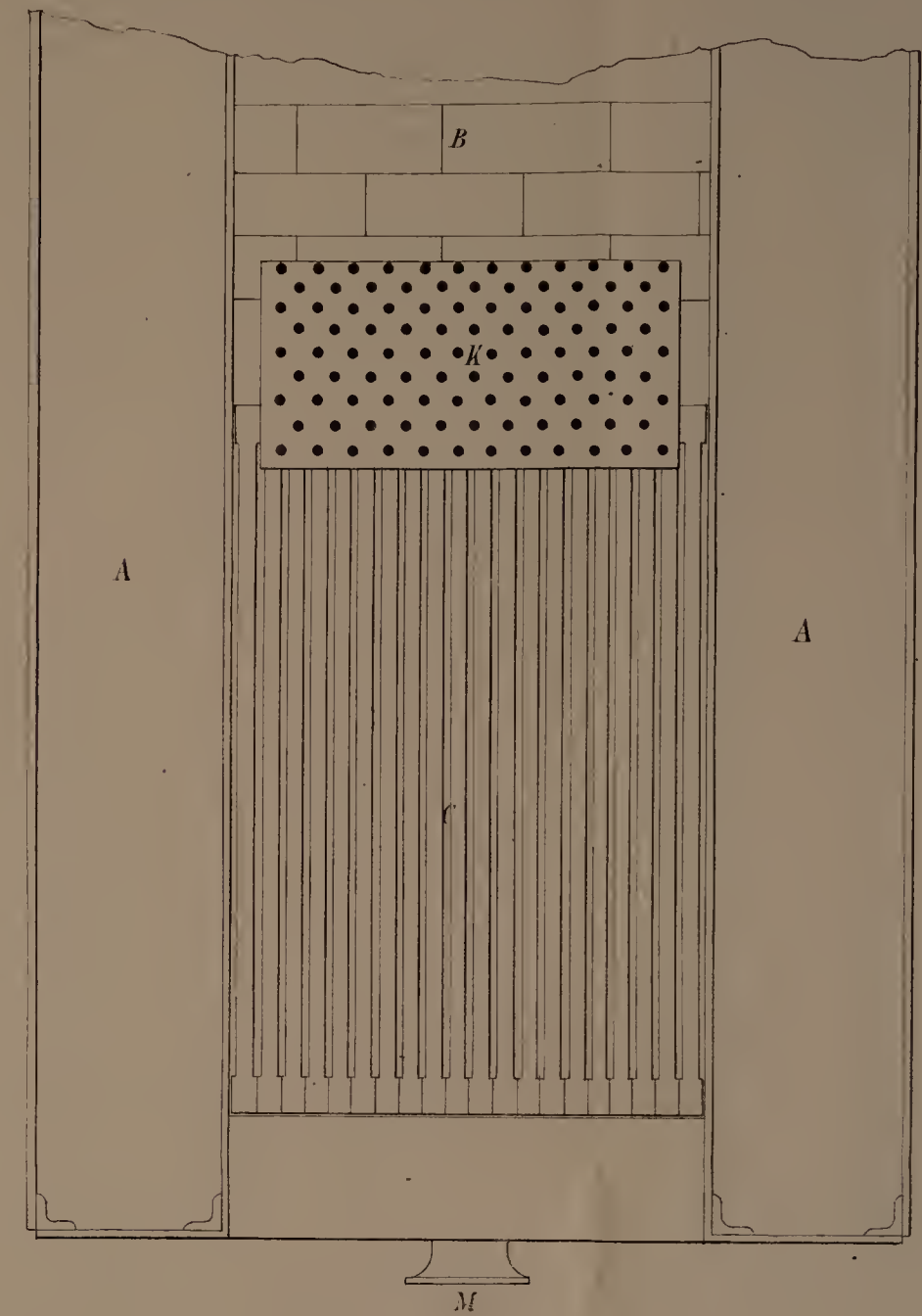


FIG. 2.

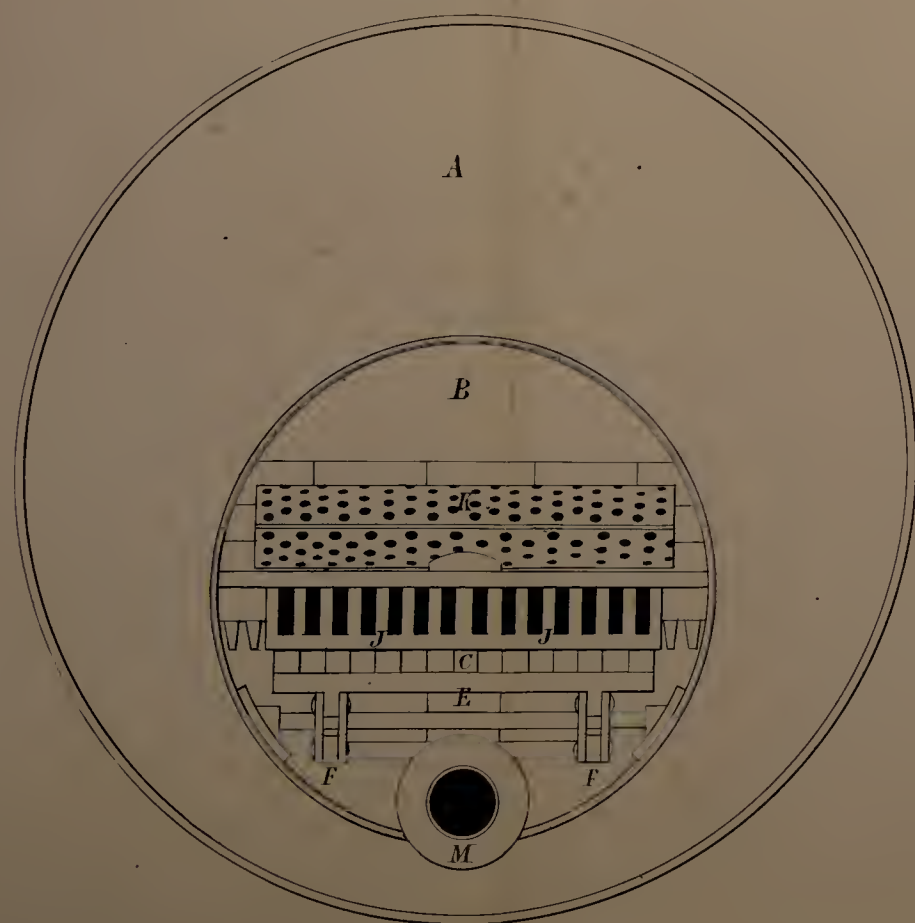


FIG. 7.

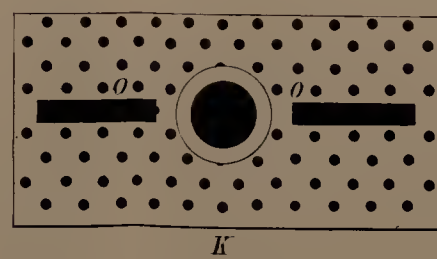


FIG. 8.



FIG. 4.

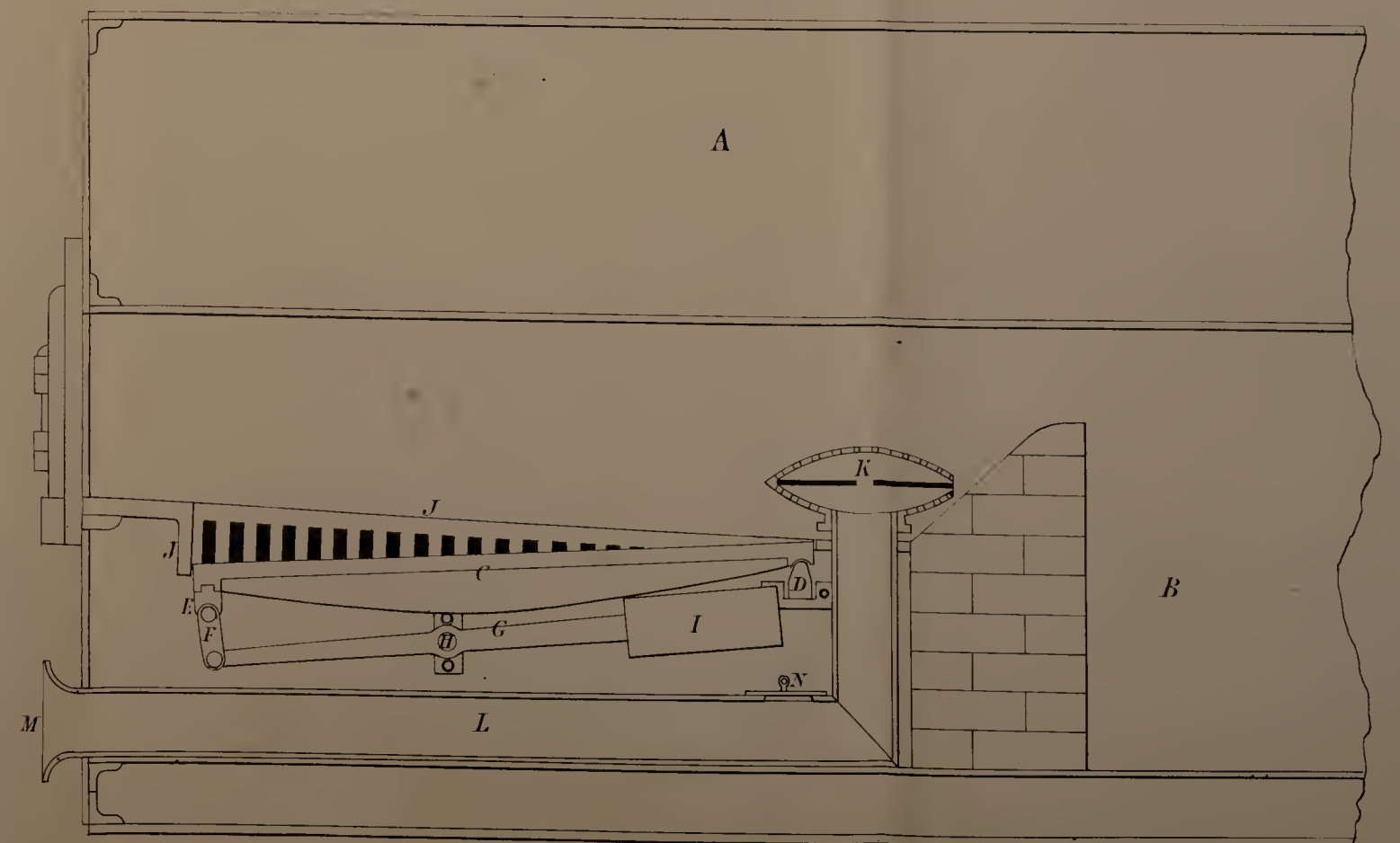


FIG. 1.

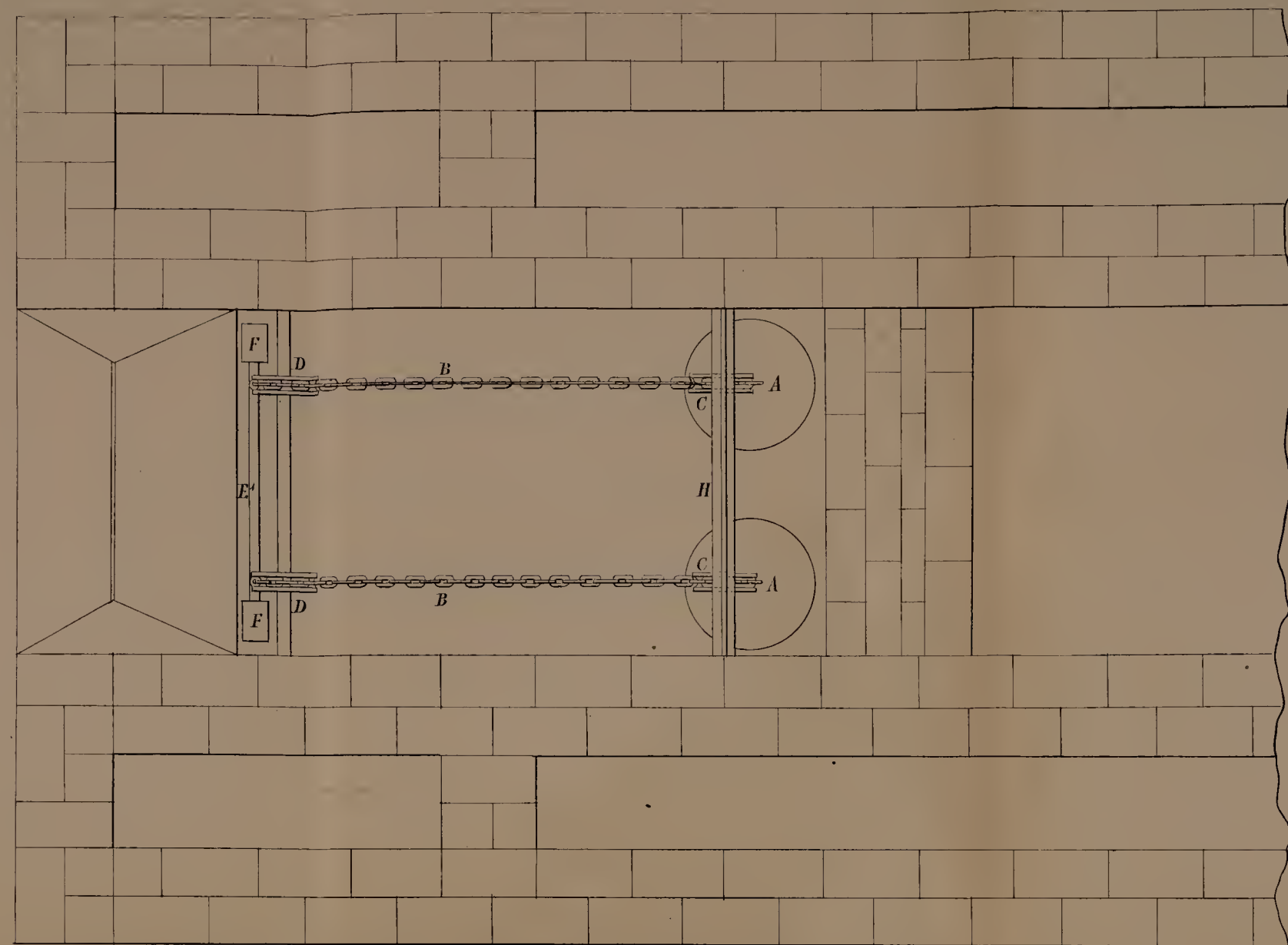


FIG. 2.

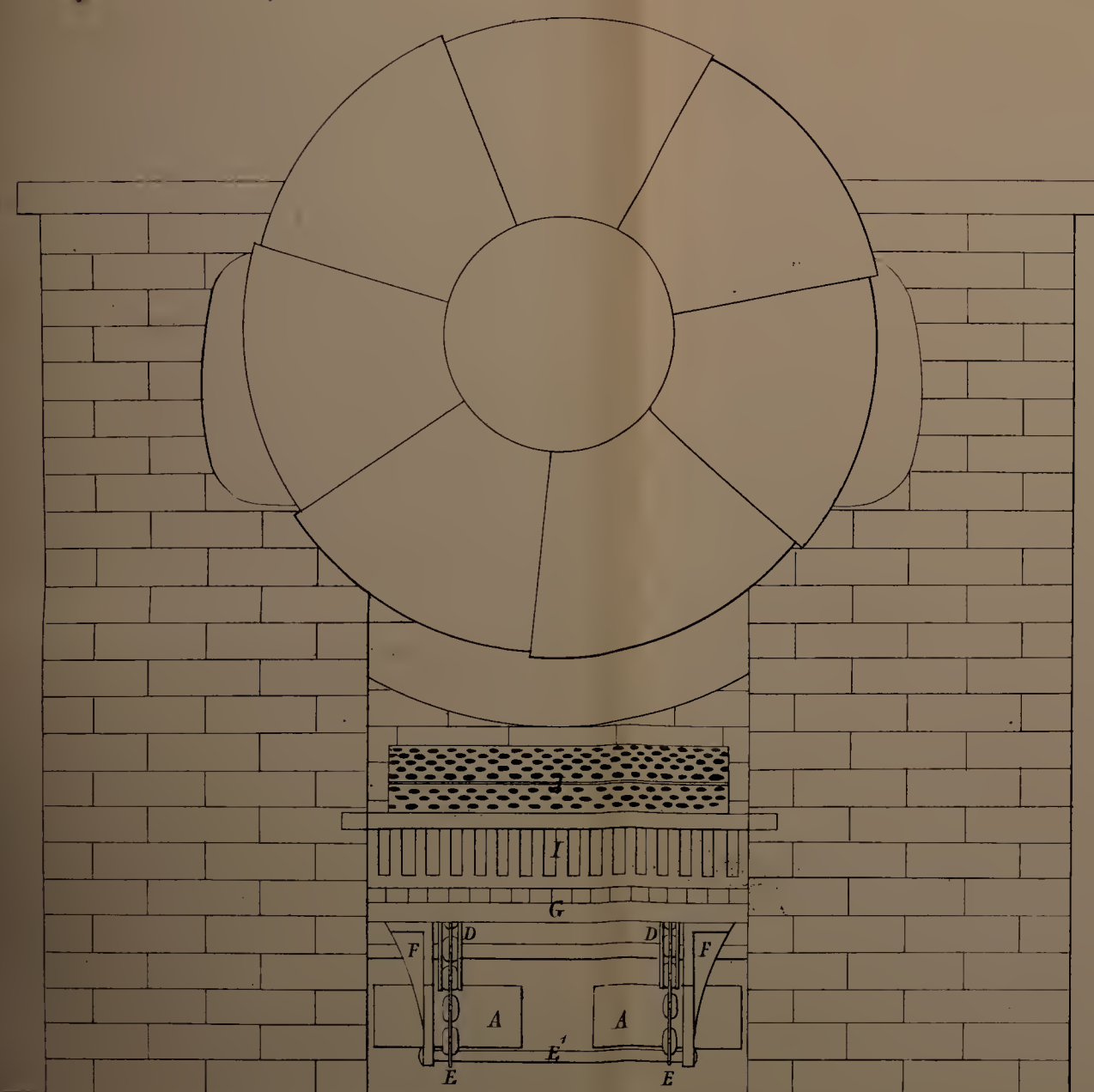
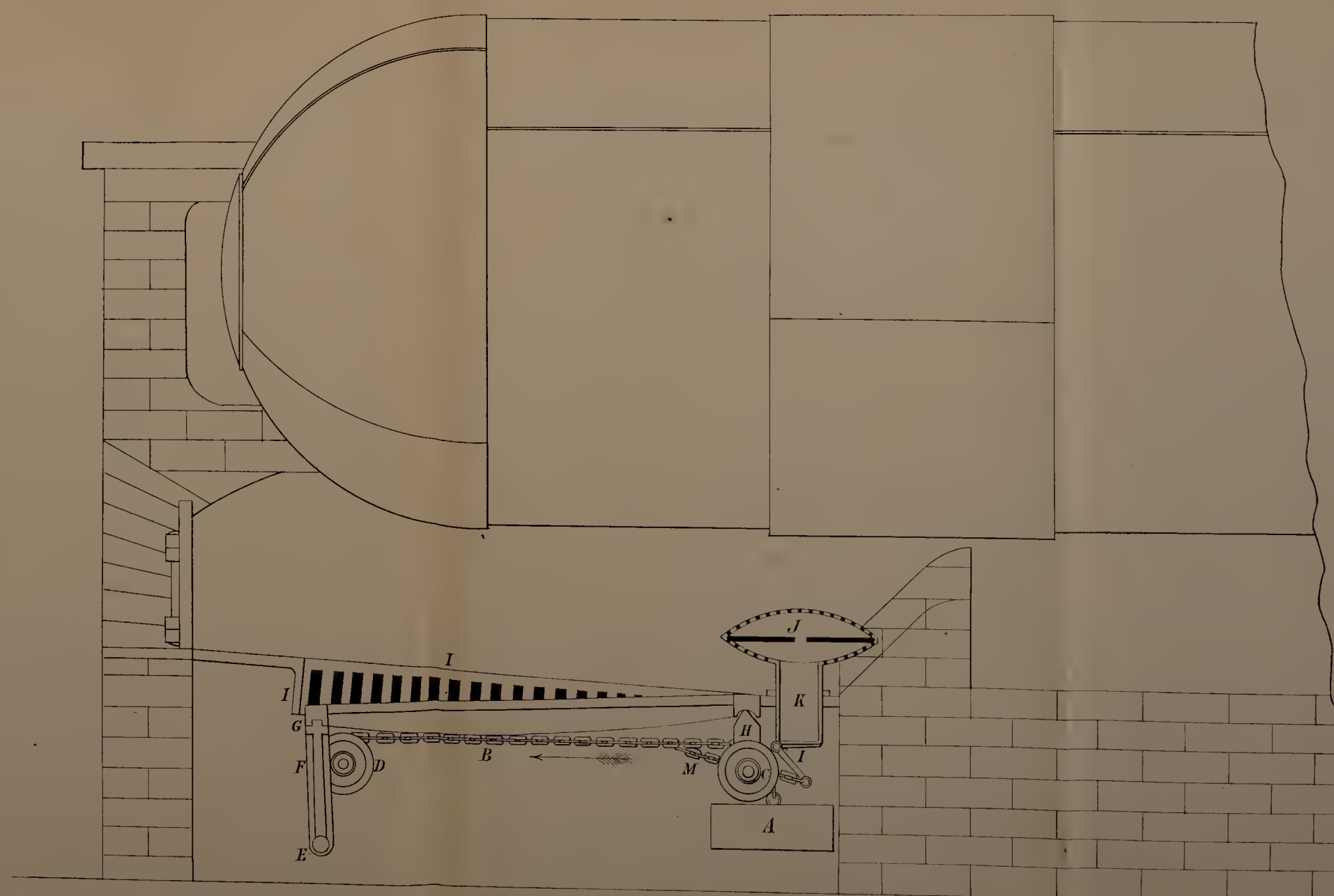
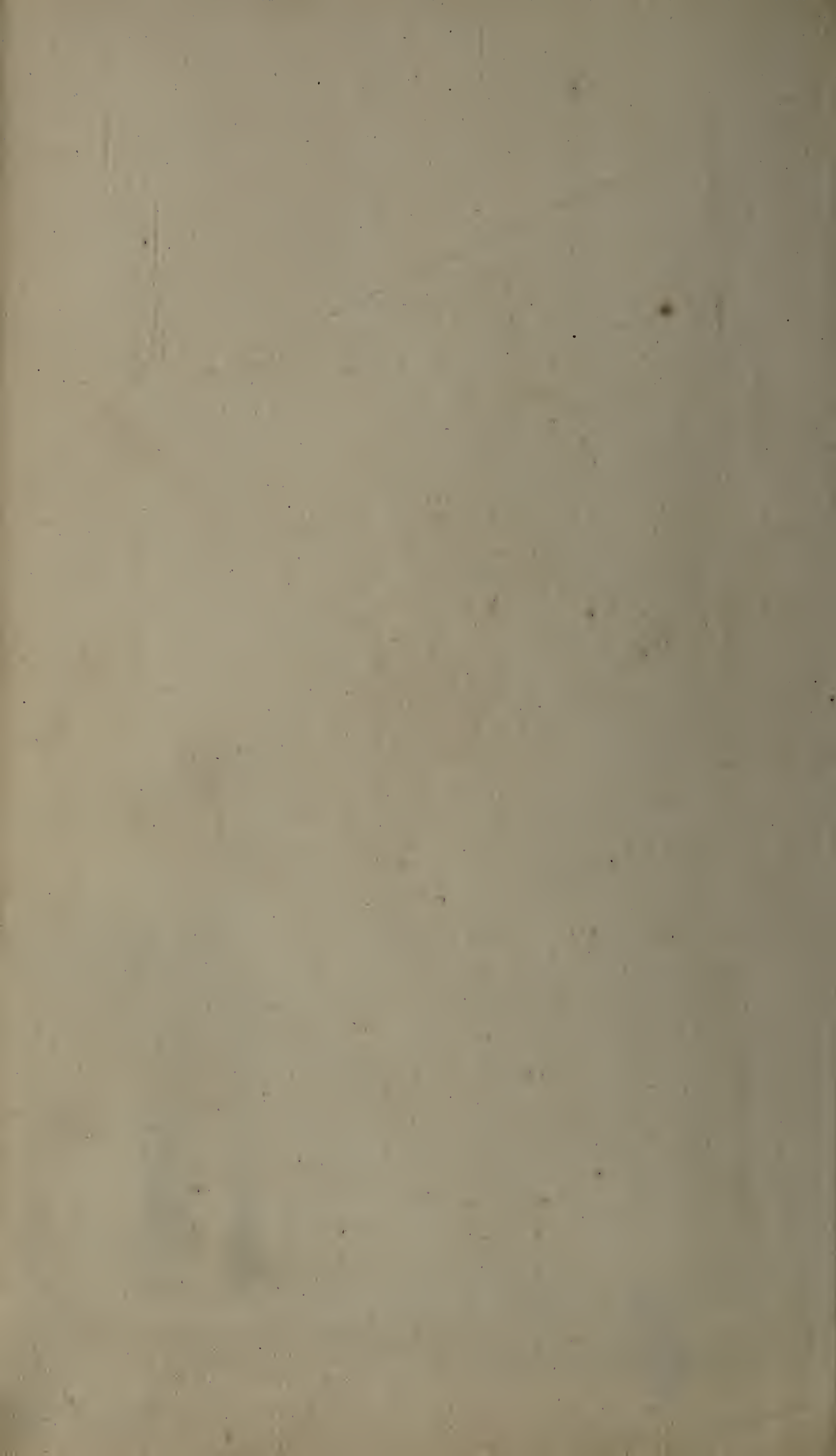


FIG. 3.



The filed drawing is colored.

Drawn on stone by Vincent Brooks 14th King St Covent Garden



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will be drawn in the direction of the arrow in Fig. 3, thereby drawing the short chain M, and effecting the opening of the valve to allow a proportionally large supply of air to enter the burner. When, however, the grate rises on account of the burning of the fuel, then the
5 valve or regulator L will gradually close, and reduce the supply of air to the furnace. But I do not claim the regulating of the supply of air to the rose J, as part of my Invention. It will thus be seen that the greatest supply of air is obtained when the fire has been supplied with fresh fuel, and the least supply when that fuel has become partially
10 consumed.

Although in the Drawings I have represented the air-regulating valve as being self-acting, it may be closed entirely by hand at any time when the air is not required. The counterweights A may be fixed either in the ashpit or in any other convenient part of the furnace.

15 Having now described and particularly ascertained the nature of my said Invention, and the manner in which the same is or may be used or carried into effect, I would observe, in conclusion, that I do not confine or restrict myself to the precise details or arrangements which I have had occasion to describe or refer to, as many variations
20 may be made therefrom without deviating from the principles or main features of my said Invention; and I may here observe, that I am aware that small streams of air have been previously employed in smoke-consuming furnaces, and that I lay no claim to the same. But what I consider to be novel and original, and therefore claim as the
25 Invention secured to me by the herein-before in part recited Letters Patent is,—

First, the general arrangement and construction of apparatus for effecting the prevention of smoke, as herein-before described.

Second, the system or mode of admitting air into the furnace by the
30 employment of a fixed perforated frame in conjunction with moveable grate bars, as herein-before described.

Third, the application and use of the perforated burner or burners, herein-before described, placed in the body of the fire at any part thereof, or as near thereto as the construction of the furnace will admit,
35 instead of in the flues, for effecting the entire or partial consumption

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of the smoke and unconsumed gases arising from imperfect combustion.

In witness whereof, I, the said James Robertson, have hereunto set my hand and seal, the Fifth day of June, One thousand eight hundred and fifty-four.

JAMES ROBERTSON. (L.S.)

LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
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